Phase I Project Summary

Firm: Michigan Aerospace Corporation
Contract Number: NNX13CP32P
Project Title: MARVY: Mars Velocity Sensor

Identification and Significance of Innovation:
MARVY addresses the development of a compact direct detection Doppler air data sensor for atmospheric reentry. This effort entails the modeling of a Fabry-Perot interferometer to detect Doppler shifts in real time using a multi-element interferometer. The overall project goals for the long term are to produce compact and rugged air data sensor representing a solution for the R&D (including space exploration), commercial and military aviation markets. The Phase I effort established the feasibility of the concept and the projected performance. Phase II will see the assembly of a bench top instrument to be tested with a well characterized flow field and a path to instrument miniaturization.

Technical Objectives and Work Plan:
All objectives were achieved in this Phase I, including the determination of the operational envelope for MARVY and the resulting requirements, the trade studies and photon budgets using models to determine the design parameters of the instrument, the design of the Fabry-Perot interferometer, and the design the full instrument for prototype fabrication and testing in Phase II. The components will be miniaturized in Phase II, after full testing of the concept and optimization of the design.

Technical Accomplishments:
The output of the model used to design the optical air data sensor indicates that the concept is viable. Photon budget calculations, the design of the interferometer and the instrument prototype design were completed in this phase, along with the Phase II work plan.

NASA Application(s):
NASA's interest in this instrument will not only be for the target use of airspeed measurement during Mars and other planetary atmospheric entry, but also for Earth sample-return capsules and other re-entry vehicles. NASA research involving UAVs and hypersonic vehicles would also benefit from this compact air data sensor.

Non-NASA Commercial Application(s):
The commercial impact of a micro-fabricated air data sensor receiver is substantial. This research and development opens the path to extremely compact optical air data systems (OADS) for UAVs, cruise missiles and other ordnance with significant flight time, and re-entry and hypersonic platforms.

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